PROCESS: MANAGE AIRCRAFT/STORES INTEGRATION

DESCRIPTION: The process of converting Aircraft and Store physical, functional and electrical requirements by conduct of analysis and test into fielded aircraft and store hardware and software.

PURPOSE: The management of aircraft/stores integration is a critical process because of the complexity in reconciling the different sets of performance and schedule requirements pertaining to the affected aircraft programs and the associated store programs. Aircraft/Store incompatibility problems adversely affect both the aircraft and the store programs, i.e., performance schedule and cost implications. This process is essential to accomplishing the mission of successfully integrating stores onto aircraft to ensure Navy carrier and Marine Corp forces can meet operational commitments.

PRECEDING PROCESS: Conduct Systems Engineering Management

INPUTS and SUPPLIERS: (INPUTS) - Aircraft and Store Technical Requirements which are provided by the respective Aircraft and Store IPTs; Program Management Plans, provided by the cognizant Aircraft Program manager, which specify the Aircraft/Store integration cost and schedule requirements that have to be met; Acquisition Program Baseline; Operational Requirements Document.

INPUTS and SUPPLIERS: (SUPPLIERS) - Aircraft Program Manager; Store Program Manager; Cognizant Aircraft and Store IPT's; Industry.

ENTRY CRITERIA: Program Manager Direction to the Aircraft/Store Integration IPT to develop plan for Integration effort; Approved Tasking and Funding to accomplish plan objectives.

PRIMARY SUB-PROCESSES: Flight Clearance Process; Conduct Technical Reviews; Develop Statements of Work; Develop Weapons Integration Plan; Provide Technical Team Structure and Composition Alternatives; Assess Technical Performance; Conduct Risk Management; Conduct Engineering Investigations; Software Support Changes, Updates and Distribution; Systems Problem Report, Problem Investigation and Resolution; Systems Integration Engineering Management; Manage Aircraft/Store Certification Process; Conduct Aircraft/Store Integration T&E; Development of Operational Flight Program.

SUPPORTING SUB-PROCESSES: Contractor Performance monitoring/measurement; Certify Aircraft/Store Configuration; Execution of Technical Disciplines (Aero, Structures, etc); Tactical Manual Development; Logistics.

AGENTS: Aircraft/Stores Integration IPT (4.1.2); OFP Developers (4.1, 4.5); 4.3; 4.3P; 4.11.

NEXT PROCESS: Logistics.

OUTPUTS and CUSTOMERS: (OUTPUTS) - Management Plans (SEMP, TEMP, WIP, POA&Ms); Aircraft/Store Integration Statements of Work; Engineering Recommendations (Risk, Design Alternatives, Trades); POM Inputs; Aircraft/Store Integration Schedules; Aircraft/Store Integration System Specifications; Aircraft/Store Flight Clearance Document; ORD Updates.

OUTPUTS and CUSTOMERS: (CUSTOMERS) - Aircraft and Store Program Managers; Fleet; Aircraft and Store IPTs; Flight Clearance Office (4.3P).

EXIT CRITERIA: Issuance of Fleet Flight Clearance by OPNAV; Successful Development and Testing to Maximize Weapon System Effectiveness.

HANDBOOKS, STANDARDS, LIMITS: MIL-STD-499; MIL-STD-1763A; MIL-STD-1760B; MIL-STD-1289A; MIL-I-8671; MIL-A-8591; MIL-HDBK-244; DoD 5000; DSMC Systems Engineering Management Guide; DSMC Mission Critical Computer Resources Management Guide; Industry Standards.

TOOLS: Aircraft/Store Integration Process Guide.

METRICS and MEASURES: Progress of the IPT in meeting the objectives delineated in the Aircraft/Store Integration Plan which was developed by the IPT and approved by the Program Manager.

VOICE of CUSTOMER: The customer expects that the aircraft/store integration effort to be successfully completed on/ ahead of schedule and within assigned budget.

VOICE of the PROCESS: The Aircraft/Store Integration process is a newly defined process, therefore, no data-driven historical performance of the process in terms of the metrics and measure exists. However, there are several noteworthy examples of aircraft/store integration project that went awry, resulting in program delays and unbudgeted integration costs, due primarily to lack of process for the program managers to follow.

Preceding Processes

Conduct Systems Engineering Management

Management of Aircraft / Stores Integration

Next Processes

Logistics Support

Purpose The process of converting aircraft and store physical functional and electrical requirements by conduct of analysis and test into fielded aircraft and store hardware and software.

Critical The application of this process is essential to accomplishing the mission of successfully integrating stores onto Navy aircraft to ensure Navy carrier and Marine Corp forces can meet operational commitments.

Inputs (Suppliers)

Inputs:

Aircraft and Store Technical Requirements
Program Management Plans
Acquisition Program Baseline
Operational Requirements Document

Suppliers:

Aircraft Program Manager
Store Program Manager
Cognizant Aircraft and Store IPTs
Industry

Primary sub-processes

Flight Clearance Process
Conduct Technical Reviews
Develop Statements of Work
Develop Weapons Integration Plan
Provide Technical Team Structure & Composition Alternatives
Assess Technical Performance
Conduct Risk Management
Conduct Engineering Investigations
Software Support Changes, Updates & Distribution
Systems Problem Report, Problem Investigation & Resolution
Systems Integration Engineering Management
Manage Aircraft / Store Certification Process
Conduct Aircraft / Store Integration T&E
Development of Operational Flight Program

Supporting sub-processes

Contractor Performance monitoring / measurement
Certify Aircraft / Store Configuration
Execution of Technical Disciplines (Aero, Structures, etc.)
Tactical Manual Development
Logistics

Outputs (Customers)

Outputs

Management Plans (SEMP, TEMP, WIP, POA&Ms)
Aircraft / Store Integration Statements of W
Engineering Recommendations (Risk, Design Alternatives, Trades)
POM Inputs
Aircraft / Store Integration Schedules
Aircraft / Store Integration System Specs
Aircraft / Store Flight Clearance Document
ORD Updates

Customers:

Aircraft and Store Program Managers
Fleet
Aircraft and Store Integrated Product Team
Flight Clearance Office (4.3P)

Entry Criteria

Program Manager Direction
Approved Tasking and Funding

Exit Criteria

Issuance of Fleet Flight Clearance by OPN
Successful Development and Testing to Maximize Weapon System Effectiveness

Agents

Aircraft / Stores Integration IPT (4.1.2)
OFP Developers (4.1, 4.5) 4.3, 4.3P, 4.11

Tools

Aircraft / Stores Integration Process Guide

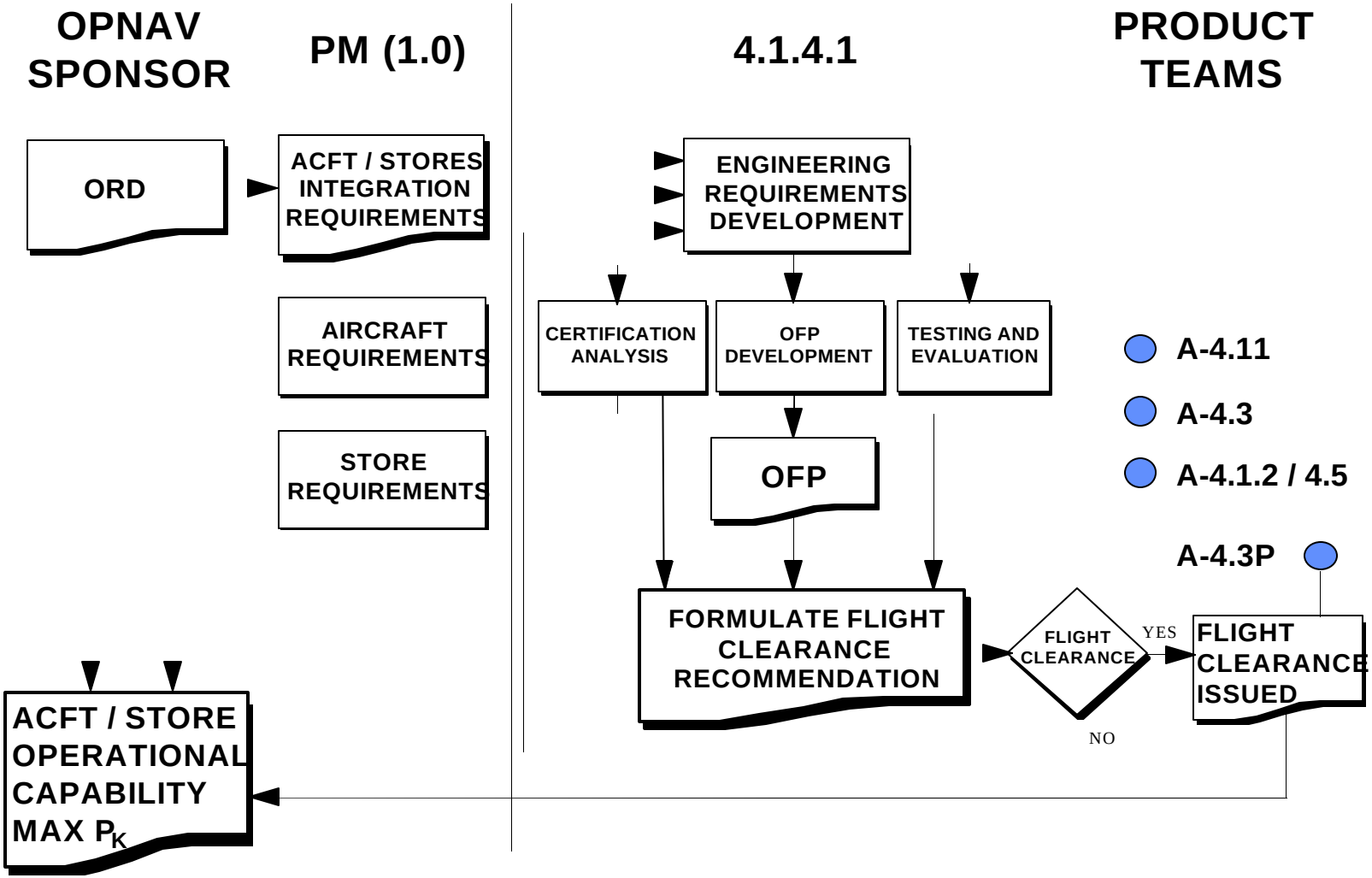
Handbooks, Standards, Limits

MIL-STD-499, MIL-STD-1763A, MIL-STD-1760B, MIL-STD-1289A, MIL-I-8671, MIL-A-8591, MIL-HDBK-244, DoD 5000, DSMC Systems Engineering Management Guide, DSMC Mission Critical Computer Resources Management Guide, Industry Standards

Metrics and Measures

Progress of the IPT in meeting the objectives delineated in the Aircraft / Store Integration Plan which was developed by the IPT and approved by the Program Manager.

AIRCRAFT / STORES INTEGRATION FLOWCHART



AIRCRAFT/STORES INTEGRATION PROCESS GUIDE

I. Introduction

This document establishes the process to be used by the Naval Aviation Systems Team (TEAM) when integrating a store onto an aircraft system. There are several instructions, specifications, and standards referenced within this instruction that define elements of this process. This document is not intended to replace or substitute for these documents, but rather serve as a guide to the entire process. A thorough understanding of this document should give program managers enough insight into the process to enable them to effectively plan and execute an integration project.

The aircraft/stores integration process can be initiated prior to the concept exploration phase of a new program or as late as follow-on testing of an existing system. This document will describe the process as it would apply to the development of a new system; however, it is equally applicable in theory to any integration effort. The intention is that an Integrated Program Teams (IPT) tailor this process to meet the need of their specific project. Figure (1) depicts the process and represents the flow diagram of events and the inter-relationships.

Experience has shown that problems that have been encountered in aircraft/store integration projects can often be traced to poor initial planning/communication, due in part to a lack of knowledge of the entire integration process, and to a lack of control of system requirements. Sub-elements of the integration process are often well understood and well managed, but the coordination between the various components of the process is where things often break down. Success of a program can often be contingent on nothing more than ensuring that the "proper" people are involved at the "right" time. Consequently, this document concentrates on describing the elements of the process in terms of the primary functions within the process and identifies the key organizational players.

The following narrative discusses each major block of figure (1), explains what happens in each block, and what coordination efforts should normally take place. Inputs and outputs of each block in the process are listed at the conclusion of each narrative. It is important to note that while suggestions are made regarding organizations and their roles, it will be up to each program to design and build IPTs to execute this process.
Definitions of key terms are contained in Appendix (A). Common Acronyms are listed in Appendix (B). When reading the text, significant information that relates to lessons learned or process improvement are highlighted with adjacent stars (*****).

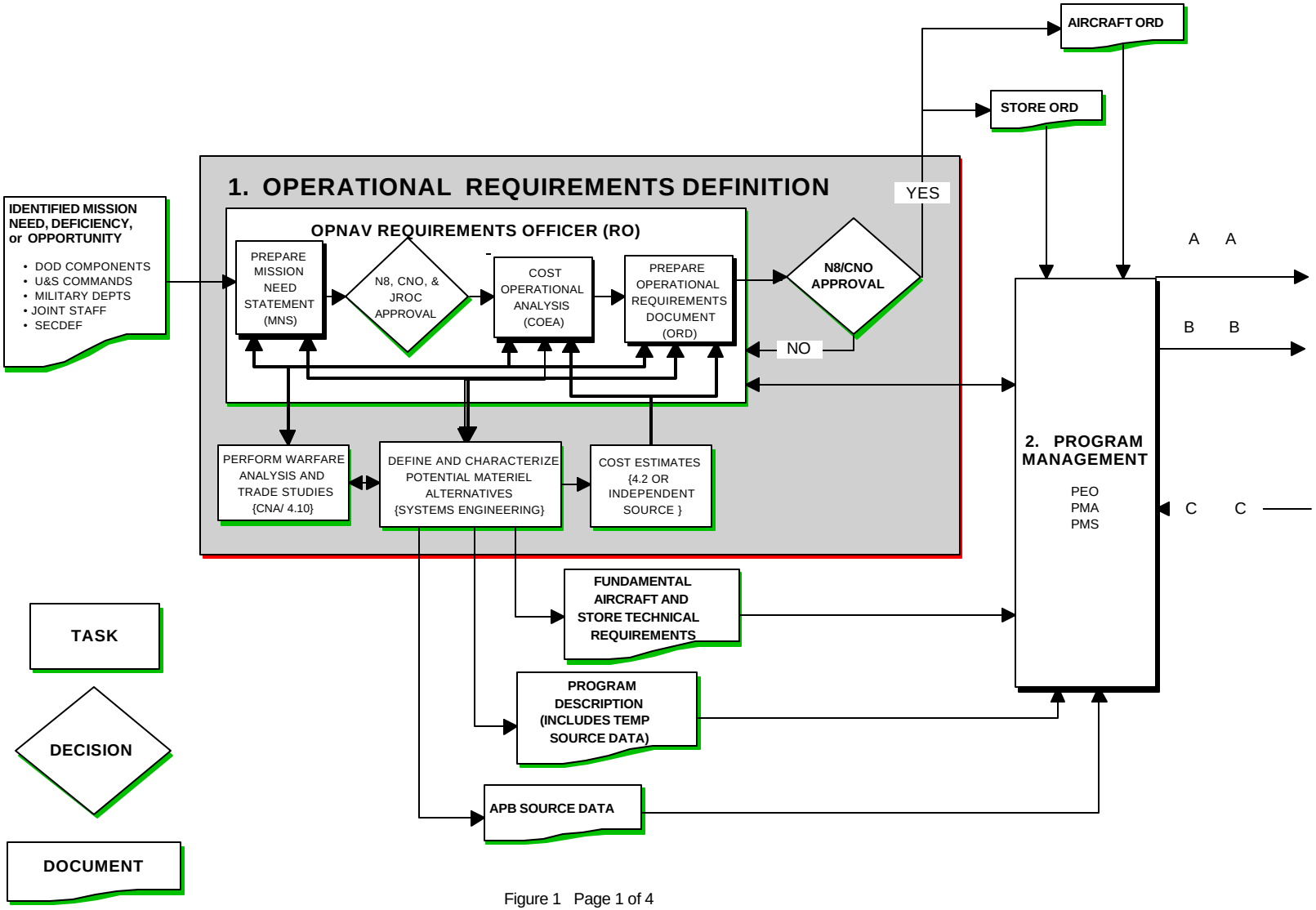


Figure 1 Page 1 of 4

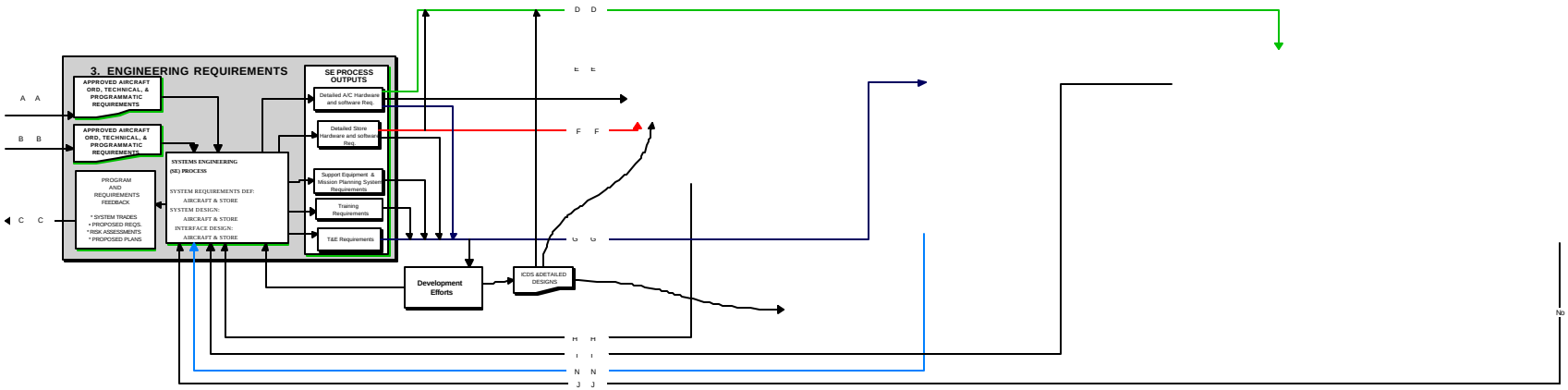


Figure 1 Page 2 of 4

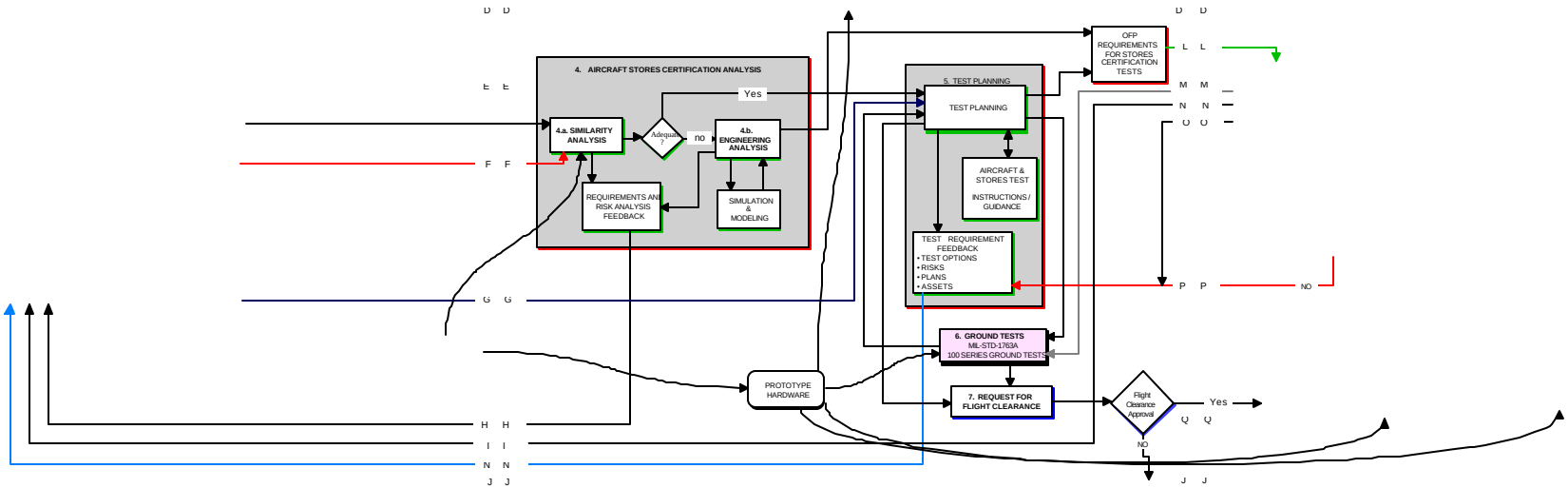


Figure 1 Page 3 of 4

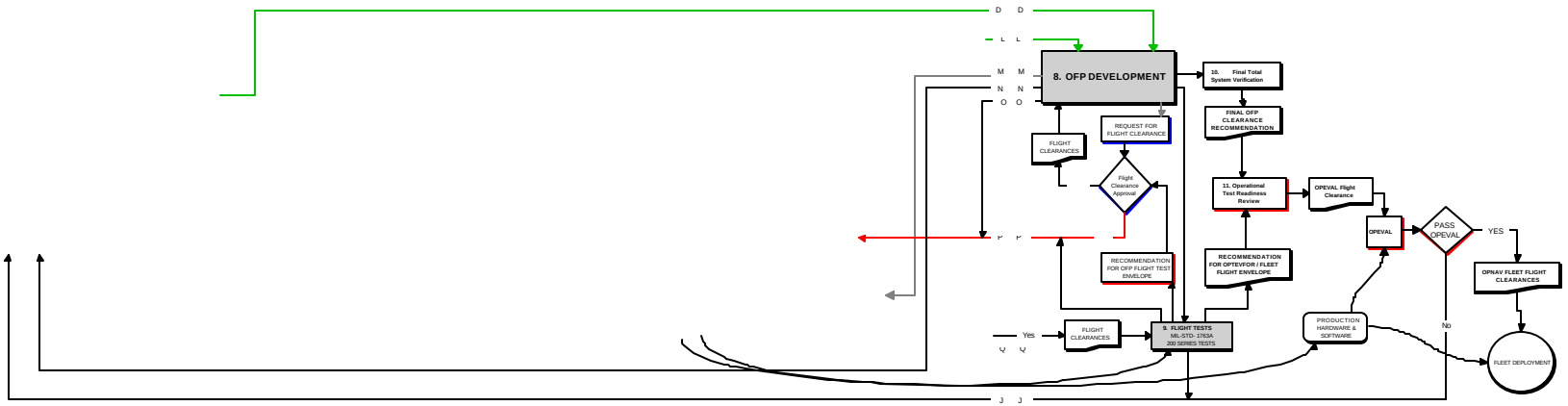


Figure 1 Page 4 of 4

1.0 Operational Requirements Definition

1.a. Overview

Regardless of when an integration effort begins in a program's life, a valid operational requirement must be generated that directs the integration of a store onto an aircraft. This is necessary not only to establish the thresholds and objectives for the key performance and related operational parameters of the system, but also to establish schedule requirements and allocate adequate funding for the integration effort. Operational requirements are typically documented in Operational Requirements Documents (ORD). Aircraft-related operational requirements may be documented in a Functional Requirements Document(FRD), in lieu of an ORD, if the store is to be added as part of an aircraft block upgrade. It is important that program managers and the IPTs for all affected systems (aircraft, store and supporting systems) be involved in the formulation of ORDs to ensure that the desired mission capability is attainable within the limitations of the planned program.

The OPNAV Requirements Officer (RO) is responsible for preparing the ORD and establishing the resource requirements for the new system. The RO should ensure that the ORD and resource requirements for any associated systems or equipment are updated to reflect incorporation of the new system (e.g., if an ORD is being generated for a new weapon to be placed on an existing aircraft, the aircraft ORD should be updated to reflect a requirement to carry this weapon). Resource requirements for the new system should also include resource requirements for its integration with other systems.

1.b. Detailed Discussion

The operational requirements definition phase begins with the identification of a need to perform a new mission, a deficiency in performing a current mission, or an opportunity to more cost effectively perform a current mission. This input can originate from any DOD component, Unified or Special Command, Military Department, the Secretary of Defense, or the Joint Staff. Based upon this input the OPNAV RO prepares a draft Mission Needs Statement (MNS). This effort should include a strong interface with the identifiers of the need to make sure that the problem and the constraints under which the problem must be solved are well understood. This understanding of the problem can be further enhanced through warfare analyses performed to obtain a more detailed understanding of the problem and establish the measures of effectiveness (MOE) and associated value system that will best determine the relative value of candidate potential materiel/non-materiel solutions.

Once the operational problem, constraints, MOEs, and associated value system are adequately defined, all potential non-materiel and materiel alternatives can be identified. The PEO/PMA and associated technical team is responsible for ensuring that all feasible materiel alternatives for meeting the need are identified.

Once it is determined that the need cannot be met by a non-materiel solution alone, the draft MNS is revised to incorporate the non-materiel alternatives considered, why they were judged to be inadequate in fully meeting the need, and the potential materiel alternatives available for meeting the need. After the draft MNS has been prepared, coordinated[1], reviewed, and comments adequately addressed, the resulting MNS is then forwarded for approval by CNO and the JROC for ACAT I or N8 for ACAT II, III, IV. The approved MNS along with established MOEs and associated value systems become an input to the Cost and Operational Effectiveness Analysis (COEA).

The primary purpose of the COEA is to determine the most cost effective, affordable materiel solution for meeting the established need. In addition, the COEA process should a) identify the key performance and related operational parameters, b) determine the ORD Thresholds[2] and Objectives[3] for each of these parameters, and c) determine the Acquisition Program Baseline (APB) Objective[4] for the concept baseline. The technical team, lead by systems engineering, should be responsible for providing the characteristics of each materiel alternative being considered in the COEA process. Characteristics of interest usually include expected performance levels, estimated time required to develop, estimated risk to develop, and other characteristics of the system and development program required by the cost estimators. Once the expected performance characteristics of each materiel alternative are adequately estimated, warfare analysis can be performed, using representative operational scenarios and the established MOEs and associated value systems, to evaluate each alternative; it is important during this effort to maintain a strong interface with the user representatives to ensure that the user's value system is accurately represented. The results of the warfare analysis, combined with established cost estimates, provide the cost effectiveness information required to refine[5] and eventually select the most cost effective and affordable alternative. The results of the COEA should be sufficient to provide the source data required to prepare the ORD, APB and draft TEMP. An additional product of the COEA process that can be available, if the technical team has been properly integrated into the process, is an outline of the top-level technical specification containing the key technical requirements that must be met, in order to meet ORD operational requirements.

In most cases the product of the Operational Requirements definition phase will be more than one ORD. In these cases the technical team should be responsible for defining alternative allocations of operational and associated technical requirements among the system elements (e.g. aircraft, store, support systems). Using the same process described above, the technical team should refine the definitions of each system element to give the best overall system cost effectiveness, considering affordability constraints. The results would then be the source data for the ORD, APB,

[1] Joint programs require RO coordination through Joint Offices.
[2] Minimum performance levels that will meet need.
[3] Beyond treshold performance levels that provide a measurable increase in operational capability or operations and support.
[4] Beyond treshold performance levels that provide the most cost effective, affordable additive capability.
[5] The technical team uses these analyses to identify opportunities to vary syst concepts and parameter performance levels to increase the cost effectiveness of alternatives.

and draft TEMP; and the fundamental technical requirements for the top-level technical specification for each required system element.

*****Early involvement of the PMA, technical team and Operational Test and Evaluation Force (OPTEVFOR) representatives is paramount. At a minimum, these organizations should review the candidate solutions for ability to satisfy the mission requirements, technical feasibility and cost effectiveness.

***** This portion of the aircraft/store integration process involves coordination of the Mission Need Statement (MNS), COEA and ORD among the OPNAV Sponsor, OPTEVFOR, PEOs and PMAs. These offices will use these documents to determine program scope, feasibility, funding requirements and development schedules for all impacted stores and aircraft. Areas of high programmatic and technical risk should be identified. The schedule requirements will be dependent upon the complexity of the systems to be integrated and iterative with OPNAV requirements development.

***** It is important to ensure that aircraft and store requirements are adequately addressed, e.g., employment of a new store should be appropriately addressed in all affected aircraft operational and technical requirements documents. The emphasis is on ensuring that the requirements for all applicable aircraft and stores are identified and budgeted for by the RO responsible for the emergent requirement. Failure to execute this coordination could result in unexecutable programs or unrealistic performance expectations.

*****During the operational requirements definition process, the RO and PEO staff should draw on the TEAM competencies to support the development of the new ORD(s). If a PMA is identified, their IPT will provide this support. Membership of the team must include technical experts in stores and aircraft integration. The PEO should ensure that PMAs and cognizant technical disciplines are addressing integration issues, responsibilities and resource requirements during formulation of the ORD(s).

*****For systems elements involved in the integration effort where a PMA has been identified, TEAM feedback on the technical and programmatic feasibility of the engineering development to meet requirement(s) is provided to the RO via the PMA. Recommendations for modification of such requirements are also provided by the TEAM.

INPUTS
- Mission Need, Deficiency, or Opportunity
- Program management support/input to the MNS development, COEA and ORD development process

OUTPUTS
- Aircraft ORD
- Stores ORD
- Fundamental Aircraft technical requirements
- Fundamental Store technical requirements
- APB source data

- Program description including TEMP source data

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2. Program Management

Upon receipt of approved ORDs and funding by the appropriate PEO/Program Manager (PM) the integration process commences. The PM manage the translation of the operational requirements into APBs, system specifications and ultimately, fully capable weapons systems. In addition, the PMs prepare the planning documentation, including TEMPs, required to accomplish this translation.

In the past, a great deal of confusion existed in determining who is responsible for integrating stores onto aircraft. The aircraft PMA is responsible for the performance of the complete weapon system (aircraft and all associated subsystems, including stores) and has sole authority to change the aircraft hardware and software to accommodate a store.

The store PM has the ultimate responsibility for the performance of the store which is directly influenced by the aircraft and how well the systems have been integrated.

*****Although the store PM may have the funding and tasking to integrate a store, the aircraft PMA has the authority and ultimate responsibility for integrating that store onto the platform.

Memoranda Of Agreement between PMs are recommended to delineate individual integration tasking and funding responsibilities prior to initiation of the integration IPT. Associate Contractor Agreements between contractors are typically needed to ensure the smooth transfer of integration information.

The Aircraft/Stores Integration IPT should be composed of systems engineers representing the aircraft and stores programs, and other personnel representing both engineering and non-engineering competencies such as logistics and contracts. This team may also receive support from industry. The IPT should be led by a senior systems engineer designated by the aircraft program manager that has been certified by the Systems Development and Integration Competency (AIR-4.1.2) as having suitable training and experience to do the job.

Outputs of the integration process may include design changes to existing equipment. Many of these changes are directed toward components of the system that are common to other aircraft or weapons (i.e. test sets, Ground Support Equipment (GSE), ancillary equipment, mission planning systems, etc.). These design changes will be identified to the Aircraft IPT by the Aircraft/Stores Integration IPT. The Aircraft IPT must communicate these requirements to the program managers for the subject equipment and coordinate the funding and schedules to incorporate changes to the equipment to meet the integration schedule.

The integration IPT should provide inputs to the appropriate TEMPs to address the planned integration testing. The TEMP provides quantifiable and feasible test requirements. Both

Development Testing and Evaluation (DT&E) technical characteristics and Operational Testing and Evaluation (OPEVAL) operational characteristics are defined. The PMA must establish early liaison with the operational tester to obtain assistance in incorporation of OT&E requirements into the TEMP.

***** Coordination with aircraft block upgrade development is crucial at this time. A successful store OPEVAL will require a fully functional aircraft Operational Flight Program (OFP). Therefore the new store requirements must be scheduled to match with an OFP block upgrade that supports major program milestones. The generation of a fleet releasable OFP can take three years from requirements identification to fleet issuance. Often two or more incremental OFPs are necessary to complete an integration effort. An initial OFP may be needed to conduct store development testing and a second OFP used to incorporate changes to the system, identified during Developmental Testing (DT), prior to OPEVAL or fleet release.

Schedules, funding allocations and overall performance objectives are used to establish a Weapon Integration Plan (WIP). Execution of the WIP will require identification of required development efforts, support, and training requirements. Areas of technical risk and risk mitigation plans must be formulated.

INPUTS
- Aircraft and store ORDs
- APB source data
- Fundamental aircraft and store technical requirements
- IPT feedback/status reports (Program and Requirements)
- Program description including TEMP source data

OUTPUTS
- Feedback to OPNAV ROs
- Aircraft and store APBs
- Approved aircraft and stores technical requirements (Specifications)
- Funding allocations
- Contracts with industry
- Program schedules
- Aircraft/Stores Integration IPT formation
- Aircraft and stores TEMPs

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3. Engineering Requirements

During this portion of the process, operational requirements are converted by the government and contractors into engineering and logistics requirements. The store and aircraft ORDs will be translated into System Specifications, Functional Requirements Documents (FRDs) and Statements of Work (SOWs) under PM/PEO direction.

Refinement of the engineering requirements continues throughout the integration process. As development and testing programs proceed, their results are incorporated into trade studies and performance assessments and, if necessary, requirements and integration plans are modified.

Under the Aircraft/Stores Integration IPT an Interface Control Working Group (ICWG) will be established. The ICWG includes engineering personnel from the TEAM and contractors. It includes representatives from avionics, suspension equipment, weapons, air vehicle (loads, structures, stores separation) and the Weapon System Support Activity (WSSA) or System Software Support Activity (SSSA). The ICWG is responsible for developing the Interface Control Document (ICD) which define the physical, functional and electrical interfaces between the store and aircraft. The ICDs will become the governing documents for the interfaces and must be agreed to by both the aircraft, store and other affected program offices.

The technical feasibility, cost and schedule risks associated with the planned integration are provided by the Aircraft/Stores Integration IPT to the program managers for their information and action. The Aircraft/Stores Integration IPT is responsible for ensuring proper interpretation of stores integration requirements, discussing performance trade-off's and restricting requirements growth.

INPUTS
- Approved Aircraft and stores ORDs
- Approved aircraft and stores technical requirements (Preliminary System Specifications).
- Approved TEMP
- Aircraft/stores compatibility analysis feedback including risk
- Test planning and requirements feedback
- Flight clearance office, ground test and flight test feedback
- Aircraft OFP Development feedback
- Other Developmental feedback (aircraft, store, support equipment, training, and T&E requirements)
- Program plan and funding allocations

OUTPUTS
- Feedback to PMA/PEO schedules, system trade studies and risk assessments
- Aircraft hardware specifications
- Aircraft OFP development requirements (FRD)
- Stores hardware and software requirements
- Support equipment & Mission Planning system requirements
- Training requirements
- Test and evaluation requirements
  - -Aircraft test requirements
  - -Store test requirements
  - -Support equipment test requirements

Appendix A
Enclosure

(1)

-Training requirements
-Test instrumentation and test range requirements
- Identification of requirements for individual development efforts
- WIP
- ICDs

3.a. Systems Engineering Process

This block depicts the systems engineering process as it is practiced within the TEAM in accordance with DODI 5000.2.

During this portion of the process, the Systems Engineering discipline of the Aircraft/Stores Integration IPT is responsible for reviewing the ORDs and developing system specifications that allocate requirements to the aircraft and store programs. Studies are used to determine the optimal approach to system design, including integration. These efforts will drive the development or modification of new or existing systems (e.g., aircraft, store and associated support equipment). The aircraft/stores integration IPT must coordinate these development efforts with existing system development efforts to ensure that all capabilities of the new systems are available for integration testing and scheduled fleet release.

Conflicts that occur in the requirements allocation process that cannot be resolved within the IPT will be elevated to the cognizant PM/PEO for resolution.

Key personnel needed during this portion of the process may extend beyond the Aircraft/Stores Integration IPT. Integrating a complex store onto an aircraft can result in major changes in the aircraft design or supporting systems. Therefore, upper levels of the aircraft program team are needed in the early phases of the integration to decide on design and program direction. Program changes outside the scope of the Aircraft/Stores Integration IPT may include ship modifications, support equipment, common electronics, and mission planning. The IPT will continually monitor project status and re-evaluate project goals, schedules, risks, etc. as needed.

A primary source of risk in this area results from design and schedule assumptions and expected technological advances that the programs were based upon that are not realized in a timely manner. Other primary sources of risk are: non-communication between the aircraft and stores developers, failure to coordinate with hardware and software developers that are not directly supporting the aircraft or weapon IPTs, uncoordinated changes to equipment interfaces.

INPUTS
- Aircraft and Store ORDs
- Detailed knowledge of the existing systems. •

Specification for all of the elements to be integrated
- Flight clearance, ground test, and flight test feedback
- Test planning and requirements feedback
- Aircraft/stores compatibility analysis feedback

(1)

- Varied developmental feedback (aircraft, stores, and support equipment, training, and T&E requirements)
- Aircraft OFP feedback

OUTPUTS
- Aircraft and store, hardware and software specifications, configuration baseline documentation, and trade studies including:
  - -Preliminary aircraft and weapon interface specification
  - -Preliminary FRD (software)
  - -Aircraft/store integration schedules
- Support equipment requirements
- Training requirements
- Test & Evaluation requirements
- Mission planning program requirements
- Program and requirements feedback
  - - System trade studies
  - - Risk assessment
  - - Formulation of plans
  - - Interface documentation that is produced by the ICWG including aircraft/stores ICDs
- WIP

3.a.1. Systems Engineering Process Outputs

Trade studies conducted to determine the optimal approach to integrating the systems will identify design requirements that will need to be addressed in order to complete the integration efforts. These design requirements may include software and/or -hardware changes, some of which may be beyond the purview of the Aircraft/Stores Integration IPT to change. The Aircraft/Stores Integration IPT must identify the needed changes to aircraft, stores, support equipment, mission planning system, training, etc. and coordinate these changes with the appropriate managers. Once the WIP is approved by the PMAs, representatives of the affected systems will be added to the Aircraft/Stores Integration IPT to ensure that integration driven changes are incorporated.

As mentioned in section 3.a. above, several major products result from the systems engineering process. The following paragraphs will describe these products in more detail. This section will not follow the general flow of the previous ones. The input and output arrows of figure (1) will not be addressed for each sub block. The five sub blocks are considered to be an expansion of the System Engineering Process.

3.a.1.a. Detailed Aircraft Hardware and Software Requirements

To integrate one or more store onto an aircraft platform, certain system capabilities must be present (e.g., compatible store carriage equipment, electrical wiring, specialized control equipment, cockpit controls and displays, etc.). Changes to the aircraft to accommodate new stores should be avoided whenever possible. However, if changes are required they should be incorporated as part of a planned block upgrade. Standard electrical (MIL-STD-1760B) and physical interfaces (MIL-A-8591) have been established for future weapons to maximize aircraft compatibility. Common interfaces can significant reduce integration costs and schedules.

Detailed design information and prototypes are used for the development of aircraft OFPs, stores compatibility analysis and testing. Therefore any design modifications, development efforts or unique interface requirements must be defined early in the integration process.

The electronic and software integration of a store onto an aircraft is governed by the aircraft's OFP development process and schedules. In many cases the OFP schedule will dictate not only the integration schedule but, can be a major driver in store development schedules.

OPNAV/PMA coordination should determine the appropriate aircraft OFP release to incorporate the store functional requirements. For complex stores the integration effort may be spread out over a series of OFPs with increasing capability.

An individual OFP requirements development process begins with the OAG surveying fleet users and collecting all outstanding software system deficiencies and desired improvements. The OAG will normally consist of representatives from Fleet Type Commanders, weapons schools, squadrons, and the Weapon System Support Activity (WSSA) or System Software Support Activity (SSSA). Newly established requirements such as new weapons and system upgrades are identified separately. The collection of deficiencies and requested improvements with supporting endorsements is reviewed by a System Change Review Board (SCRB) and formulated into a FRD. The OAG, in conjunction with the SCRB, will update and prioritize all proposed changes and develop a list of requested changes.

This list then undergoes an executability assessment that evaluates schedule, risks, and resource availability of the proposed changes. Upon completion of the executability assessment, an updated FRD is then presented to the Aircraft SCRB for approval. This approved FRD establishes the functional requirements baseline of the aircraft block upgrade and the OFP. The OFP development process is described in Section 8.0.

*****After the FRD has been approved by the SCRB, its content is tightly controlled. No new functional requirements can be added to the FRD without significant impact to the OFP schedule.

3.a.1.b. Detailed Store Hardware and Software Requirements

Just as aircraft may need to be modified to accommodate new stores, the stores may need to be modified to be compatible with new aircraft. Store software may need to be modified for

separation concerns or signal blanking and structures may need to be reinforced to survive the rigors of captive carriage on newer platforms. The details of these changes will affect aircraft hardware, software, integration analysis, and tests. Incorporation of store modifications can often be cost prohibitive due to the large store inventories. Operational envelope changes or functional limitations may provide more cost effective alternatives than extensive store modifications.

3.a.1.c. Support Equipment Requirements/Mission Planning System

Part of the engineering activity is to define the requirements for changes or enhancements to any associated support systems. Generally new stores and aircraft are required to use existing/common support equipment. However, unique or modified existing equipment is sometimes required. The aircraft IPT needs to make any requirements for changes to GSE known to the GSE managers so that development schedules or squadron allocations can be changed to meet integration plans. Unique loading or testing equipment should be evaluated in conjunction with the fit and function tests of MIL-STD-1289.

*****Updates to the Tactical Aircraft Mission Planning System (TAMPS) must be addressed during the requirements identification portion of the integration effort by the integration IPT. Development (for new aircraft and/or stores) and/or update of several TAMPS modules or core software may be required for an individual integration project and must be included as part of WIP. For the aircraft IPT, TAMPS requirements should be included in the aircraft Functional Requirements Document(FRD). The FRD must include the requirement to use the new or modified stores, and aircraft modules. As the TAMPS system expands to include the SPWM (includes the tactical manuals, target weaponeering and store programming functions), inclusion of its requirements becomes mandatory.

It is incumbent upon the PM with the emergent requirement to plan and budget for the resources required to accomplish TAMPS integration for the aircraft and store. That is, the new (or modified) aircraft or store program office must provide the resources for the update or development of the store, aircraft, and SPWM modules.

3.a.1.d. Logistics Requirements

Logistic requirements, which are identified during the Logistics Support Analysis (LSA) can be important to the successful integration of a store onto an aircraft platform. The Integrated Logistics Support Plan (ILSP) reflects planning for the following logistics elements considered especially important for aircraft/stores integration; trainers/training, support equipment (i.e., loading and test), and publications. Consideration and planning for these logistics elements should begin not later than approval of the weapon ORD. The integration IPT should coordinate with the aircraft and weapon logistics manager to ensure that the LSA schedule will provide the necessary support resources in time to support store integration onto the aircraft platform.

PMA-205 is the responsible program manager for the development and availability of appropriate operational and maintenance trainers and associated training courses. Trainers and training courses are developed for the benefit of the aircrew, loading crew, and the explosive

ordnance disposal team. If the integration effort is initiated by a weapon ORD, the PMA-205 aircraft and weapon training systems manager will coordinate with the weapon program manager to budget for development of the appropriate aircraft and weapon training courses and trainer modifications. To be successful, the PMA-205 training systems managers must be advised of aircraft/weapon functionality requirements, and aircraft OFP release plans, as early as practicable. In conjunction with the integration IPT, the aircraft training systems manager will coordinate with the weapon IPT to define functional requirements and required delivery schedules for weapon training shapes and simulators.

The integration IPT should plan to evaluate new or modified loading or test equipment early during aircraft and weapon system development or modification. Accordingly, coordination with the appropriate support equipment program manager is important to establish technical and scheduling requirements. (this guidance relates to paragraph 3.a.1.c above).

The integration IPT should ensure that relevant source data (i.e., weapon/aircraft functionality, loading parameter, employment, etc.) are provided to the publications logistics element manager for inclusion in affected publications such as weapons loading manuals, NATOPS and tactical manuals.

3.a.1.e. Test and Evaluation Requirements

As the aircraft and store hardware and software requirements are developed and specifications created, testing will be required to verify these requirements. During this part of the process, test requirements must be identified for all parts of the system. A master test plan should be generated as an output of this effort. This should not be confused with the TEMP. The TEMP will not contain the degree of detail that will be reflected in the master test plan, however, the master test plan should have traceability to the TEMP. The master test plan should detail all required tests and data needed to support system development, flight clearances, and functional tests. This document will be enhanced and have details incorporated as part of the test planning efforts described in Section 5.0. A list of all required test assets should be identified and provided to the PMAs for incorporation into Non-Combat Expenditure Requests or procured through contractor actions.

3.b. Development Efforts

As indicated in Paragraph 3.a, trade studies conducted as part of the systems engineering process may recommend that changes be made to existing equipment or that new equipment be developed to optimize the aircraft/store system. These development efforts, while important to the store/aircraft performance, may not be under the direct control of the integration IPT. This is particularly true for common avionics, support equipment and common ancillary equipment. Detailed equipment designs or modified equipment may be required for integration ground tests, flight tests and software development. Therefore, careful coordination of development schedules, funding and asset availability is required. The integration process chart includes this area to acknowledge this required coordination and its impact on the systems engineering process.

4. Aircraft/Stores Compatibility Analysis

This portion of the process deals with the engineering analysis performed to establish the structural and aerodynamic compatibility of the aircraft/store combination. The intent of this part of the integration process is to determine the most efficient method to certify the new aircraft/ store combination(s) are suitable for flight. There are two elements of compatibility analysis: similarity analysis and engineering analysis. Regarding figure (1), only these two areas are addressed specifically.

4.a. Similarity Analysis

Similarity analysis is the process of comparing the proposed aircraft/store combination with previously approved aircraft/store combinations. In some cases the similarity analysis may be the only analysis required. The easiest case is for a slightly modified store for use on an aircraft already approved for the unmodified store. The data required for the analysis to confirm the similarity is described in MIL-STD-1763A, paragraph 5.1.2. If the data supports a similarity determination then flight clearances can be granted with no further analysis. If the analysis does not justify similarity, then ground tests and/or flight tests may be required as determined through detailed engineering analysis.

Even when it is obvious that the aircraft/store combination cannot be approved by similarity, this type of analysis can help a program if it is performed early. A review of the same type of data required for similarity analysis will assist in estimating the scope of the ground and flight test efforts, program schedule, and cost.

The similarity analysis is conducted by engineers from the Air Vehicle Engineering Competency. The data to support this analysis is gathered by either TEAM engineers and/or contractor engineers. The amount of data involved varies with the complexity of the aircraft/store combination. In its simplest form it is a summary of store, aircraft and associated hardware: inertial properties (weight, center of gravity, moments of inertia), desired loading, flight envelopes, operational considerations and engineering drawings.

INPUTS
- Detailed aircraft and store hardware and software requirements

OUTPUTS
- Similarity analysis findings and reports
- Aircraft and store requirements and risk analysis feedback
- Flight clearance recommendations as appropriate

4.b. Engineering Analysis

The engineering analysis phase involves conducting the analysis described in MIL-STD-1763A, paragraph 5.1.4, and will determine static strength, flutter speed, drag, pitching moment,

propulsion effects and separation trajectories. In some cases the data required for this analysis is available from either the aircraft or store development program. Where the data does not exist it must be generated by analytical tools such as computational fluid dynamics and from ground tests such as static strength, wind tunnel, ground vibration, or electromagnetic interference. These ground tests are explained further in section 6.0 of this document and in Mil STD-1763A. The analysis can be done by industry or TEAM engineers depending on the program and the technical discipline involved, however, this analysis will be used as the basis for a flight clearance. Therefore the 4.3 Air Vehicle Competency must approve the analysis methods and personnel conducting the analysis to ensure they will accept the results.

Much of the analysis involves simulation or modeling. For example, store release or launch trajectories can be modeled using a six-degree-of-freedom computer simulation. The resulting trajectories are used to identify problem areas in the flight envelope and can be used to make recommendations for design changes in the aircraft and/or store. Other computer based models are used to analyze structural problems, propulsion issues, and other areas of concern. The results are formally documented in engineering reports.

Once the analysis has been completed, a formal decision is made that either: the aircraft/store combination is recommended for flight clearance; or recommendation is made for ground test and/or flight test. This is a collective decision by Aircraft/Stores Integration IPT and is coordinated with the Flight Clearance Office (AIR-4.3P). Engineering data, ground test data, and analysis feed into this decision and the flight test planning process to ensure that the flight test portion is optimized to obtain the appropriate data in the minimum time and minimum cost.

Often there is neither time nor resources available to do the appropriate amount of analysis, especially if it will require ground tests such as wind tunnel testing. Reductions in the analysis phase translate into increased risk and/or scope in the flight test phase. Reductions in the engineering analysis phase may lead to a failure to identify technical risk areas that will eventually produce a reduced or severely limited fleet flight envelope.

*****Tradeoffs must be performed between up front analysis and the associated costs for each approach vs. the probability that the identified risks will be realized during testing.

INPUTS
- Simulation and modeling requirements
- Similarity analysis findings
- Engineering designs for aircraft and stores

OUTPUTS
- Aircraft/stores engineering analysis (This will feed ground and flight test planning requirements)
- Aircraft/stores engineering analysis results pertaining to OFP ground and flight requirements
- Simulation and modeling data
- Feedback to requirements and risk analysis
- Recommendation for fleet flight clearance
  or

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- Ground test planning requirements
- Flight test planning requirements
- Flight clearances for tests

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5. Test Planning

The biggest mistakes made in this area are not including all appropriate competencies in the test planning process and not planning early enough. Poor test coordination has been a major contributor to excessive costs and schedule delays. Planning early, with input from all parties, optimizes efficient use of test resources, and data exchanges.

The Aircraft/Stores Integration IPT will identify detailed aircraft and/or weapon DT testing requirements. These requirements will be documented in the TEMP and passed to the IPT responsible for T&E (if different from the Aircraft/Stores Integration IPT) for detailed test planning and coordination with existing test schedules and asset requests. T&E competency representatives on the integration IPT will ensure that a coordinated, efficient test program is planned which optimizes use of concurrent testing and maximizes data exchange. Test planning should concurrently address the stores integration testing and any necessary stores or aircraft testing to include overall aircraft/store effectiveness tests.

The initial test planning will occur during the engineering requirements development stage. A general test schedule should be outlined, although, exact test, assets and costs, cannot be promulgated until the compatibility engineering analysis is conducted. It is during early test planning meetings that decisions can be made as to identification of test tools (e.g. instrumented stores, photogrammetrics) and who will be involved (e.g. Navy, stores contractor, aircraft contractor) and what roles they will assume during testing.

The test planning process continues interactively throughout the compatibility analysis process**.** As analysis is completed, ground test are planned, executed and test results used to re-evaluate compatibility analyses and plan flight tests. Throughout this process, any data that affects overall program schedule milestones, costs, TEMP, etc. are fed back to systems engineers for analysis. The results of this analysis will include examination of options and assessment of associated risks for each testing option: Should the IPT/PMA elect to assume more risk.

Test results that indicate ORD requirements cannot be met should be elevated to the PMA for review with OPNAV so that requirements can be modified and/or the scope/schedule/resources of the integration effort changed.

*****A common mistake is committing to test cost, asset and schedule requirements prior to completing the compatibility analyses. Inflexibility in programs sometimes precludes making changes to preliminary plans. Inclusion of appropriate systems engineering and T&E engineering personnel in initial planning ensures statements of work, funding, necessary test tools, and test assets will be in place in time to meet the program schedules.

The test planning phase defines all test assets (expendable and non-expendable), test plans, instrumentation, and facilities. Non-Combat Expenditure Requirements will be identified and obtained by the PMA.

INPUTS	• Aircraft and stores compatibility engineering analyses. • Test and evaluation requirements for aircraft, stores, support equipment, and training • OFP development flight clearance requirements • OPNAV, OPTEVFOR, and engineering requirements, analysis data, and test feedback, including data from aircraft or store development tests.
OUTPUTS	• OFP requirements for stores compatibility tests • Aircraft and store ground test requirements • Aircraft and store flight test requirements • System Engineering feedback regarding risks, plans, test requirements, and assets/NCER. • Work unit plans and SOWs

6. Ground Tests - MIL-STD-1763A 100 Series Tests

Ground tests are conducted in order to supply necessary data to support analyses and to provide baseline data for risk assessment and basic functionality assessment. Data from these tests combined with engineering analysis provide supporting information for the identification of flight test requirements, initial flight clearance envelopes and development of weapon handling and loading procedures. The technical elements to be considered in this area are listed as series 100 tests in MIL-STD-1763A. Refer to MIL-STD-1763A for individual test data requirements, test preparation instructions, required test equipment, test instrumentation, prescribed test conditions, acceptance criteria, and reporting requirements.

The series 100 tests support two major efforts; captive carriage and stores separation. Support of captive carriage can be further broken down into four areas of concern; (1) structural testing, (2) aerodynamic testing, (3) form/fit/function, and (4)environmental tests.

The data acquisition requirements are specified by members of the Air Vehicle Engineering Competency (AIR-4.3) to meet the requirements of the flight clearance process.

It is important to address all the technical elements covered by the series 100 tests in order to ensure a safe and predictable transition to flight testing. The conduct of proper ground testing is essential to minimize "technical risks " at latter stages of the program. Ground tests may also yield data

necessary to perform analysis which may result in some technical elements being fulfilled without additional testing (clearance by analysis).

As the complexity of store and aircraft systems increases, the need for software for some ground tests is likely to increase. In some ground tests, elements may be repeated as the evolution of the aircraft and or store continues from Demonstration/Validation (DEM/VAL) to Follow on Operational Test and Evaluation (FOT&E).

Electromagnetic compatibility (E^3) testing is often conducted both at the subsystem and system level. A first look is taken to identify problems in avionics and software. Later, E^3 test are conducted with a mature avionics complement and software load to ensure compatibility. E^3 tests require final versions of both hardware and software and are usually deferred until production representative equipment is available. E^3 test facilities are limited, therefore, tests must be scheduled well in advance.

The important outcomes of the ground test process are the answers to the basic questions:
- Will the store fit onto the host platform's suspension equipment?
- Are there any incompatibilities with regard to the electrical/communication umbilical?
- Does the store survive the predicted vibration environment of the host platform?
- What are the separation characteristics imparted to the store by the suspension/release equipment?
- Are basic structure and strength requirements being met by the aircraft/store interface?
- Are there any initial roadblocks to the integration of the store with regards to: aero-acoustics, Hazards of Electromagnetic Radiation to Ordnance (HERO), EMC, thermal extremes, etc.?

The outcome of these tests are provided as formal written reports with both raw and processed data. Initial data may be presented by oral or informal presentations at time critical phases of a programs execution.

INPUTS	• Test planning requirements • OFP requirements • Ground test software
OUTPUTS	• Flight clearance inputs • Feedback to engineering requirements • Ground test data and reports

7. Request for Flight Clearance

The details for the actions necessary to request and grant a flight clearance are given in NAVAIRINST 13034.1A. The flight clearance is temporary approval for flight in a nonstandard configuration or for operation outside the NATOPS or TACMAN envelopes. A flight clearance is required when an aircraft carries or releases a store in a configuration or envelop not covered by existing Tactical Manual limitations. During an integration program separate flight clearances may

be needed for carriage tests, separation tests, launching/firing tests, software V&V, Techeval, OPEVAL and final fleet release of the system.

***** The flight clearance request must be made formally at least 45 days prior to the need date to AIR-4.3P, the Flight Clearance Office for the TEAM. Personnel from the Aircraft/ Stores Integration IPT will coordinate the flight clearance request with AIR-4.3P. Each competency/technical discipline that is affected by the flight clearance request will review the supporting data for the request. With prior coordination these engineers will have already been working with the test activity and will have identified the data required to support the flight clearance request.

*****The time to begin planning the flight clearance is when the Aircraft/store integration configuration is first identified. At this point, the technical disciplines involved in the approval of the flight clearance can be identified, their needs documented and analysis/tests planned. A requirement for a flight clearance will initiate actions in the analysis portion of the process, which will identify needs for ground tests that must be factored into the overall test planning. This interaction must occur in a timely manner. Delays in a flight test program can be costly when weapon systems and supporting personnel wait for a flight clearance that is being held up due to an incomplete or uncoordinated request.

INPUTS	•	Ground test results, reports, analysis
	•	Test planning requirements
OUTPUTS	•	Flight clearance recommendations

8. OPERATIONAL FLIGHT PROGRAM

The development of aircraft OFPs and block upgrades are controlled by processes being documented by the AIR-4.1 WSSA competency. This section summarizes the OFP process and identifies those areas/events that are significant to aircraft/stores integration.

Aircraft/store integration requirements must be coordinated with the aircraft OFP development process. The aircraft OFP process is controlled separately from the stores integration process. It is typically managed for the aircraft program manager by a SSSA or WSSA. It is incumbent on the aircraft/store integration IPT to ensure that store interface OFP requirements are defined and provided to the aircraft SSSA/WSSA.

During stores development and testing, aircraft avionics and software may be required for conducting ground and flight test. These requirements must be identified early in the planning process so that incremental software releases (test tapes or overlays) can be produced to support stores compatibility and integration testing.

OFP updates typically are planned to occur on a regular basis. For example, the F/A-18 program plans to upgrade its OFP every two years. The process is tightly controlled to ensure

timely releases to the fleet and to maintain software configuration control. An aircraft OFP update will normally be initiated to correct problems uncovered during system employment or to upgrade systems on the aircraft. The process of determining functional requirements for OFP development was introduced in the Engineering Requirements Section 3.a.1.a

Aircraft system avionics and software design and development efforts are accomplished as the aircraft/weapon system FRD evolves. Hardware changes are implemented through Engineering Change Proposals. For software, generally, these changes are incorporated via Block Upgrades timed to lead or coincide with hardware improvements. The software development process consists of development phases and formal reviews (i.e. System Concept Reviews(SCR)/System Design Reviews(SDR), PDR, CDR), leading to a final software block release. At the SCR, the preliminary aircraft/store Interface Control Document(ICD) must be agreed upon by both the aircraft and store PMAs. The ICD will be used to control the defined interfaces during avionics hardware and software development. When CDR exit criteria are met the systems functional requirements are officially approved. The process then continues with software development, avionics hardware prototyping and testing. Testing typically uses software emulations, laboratory tests, aircraft ground tests, and aircraft flight tests. Normally, development and integration laboratories, which possess major portions of aircraft and store avionics, are extensively used in this development and test process.

Once the OFP has been developed and ready to enter Verification and Validation (V&V) testing, it will undergo a final SCRB review and a "Hard Freeze". At this point, the FRD is finalized and no changes will be permitted except to correct deficiencies identified during V&V testing. Store development activities that impact the interface with the aircraft should be completed at this time.

*****Any changes to the aircraft OFP required by the store that are identified after this freeze will be deferred until the next OFP release/block upgrade.

V&V tests evaluate the OFP functions using fleet representative hardware and software to ensure compatibility prior to the fleet receiving the system. This involves flight tests, often with releases of fully functional stores at targets, to verify post launch controls, weapon hand-off signals or ballistics. V&V flight test requirements need to be identified early in the program and coordinated with store compatibility flight testing. Flight clearances are required for V&V tests and need to be requested with sufficient lead time to preclude impacting planned test schedules.

***** Stores compatibility flight tests are normally conducted prior to the V&V tests to establish safe carriage and release envelope. However, in some instances, there are savings to be obtained by combining stores compatibility and V&V tests.

INPUTS
- OFP requirements for stores compatibility tests
- Detailed aircraft hardware and software requirements
- Flight clearance

OUTPUTS
- Final OFP system ready for verification
- Requests for flight clearance
- Ground test OFP software support requirements
- Flight test OFP software
- Training program/Fleet introduction package

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9. Flight Tests MIL-STD-1763A 200 Series Tests

*****Flight testing is often the most expensive phase of a integration program, therefore efforts should be made to use results of the ground test and analysis phases to minimize flight test efforts where possible. This requires a close working relationship between the engineers doing the analysis and the engineers doing the testing. This working relationship is essential to both test planning and test execution.

The MIL-STD-1763A 200 Series Tests are conducted to gather critical data on the aircraft/store combination. Each test is independent but may be grouped into four general categories; air worthiness testing, separation and jettison, ballistics, and OFP development/verification tests. Generally, this family of tests establishes:

- the ability to carry the store on the host platform;
- carrier take-off and landing limitations;
- safe stores separation limitations envelope;
- aircraft specific and/or free stream ballistics;
- that the OFP provides for safe and effective store delivery.

The airborne test requirements, as determined by Aircraft/Stores Integration IPT, are established to determine which tests need to be conducted and the scope of each test. Contractor analysis typically plays a large role in this endeavor. Some limited flight envelopes for aircraft store combinations may be granted with no testing on the basis of analysis, but these typically are very conservative.

During the store compatibility analysis, ground test and flight test phases, there are interim reports published which include partial flight clearance recommendations (carriage, carrier suit, jettison, etc.). At the conclusion of all applicable tests, a final flight envelope recommendation is generated, which encompasses all technical areas. This recommendation is usually generated via message, but is sometimes included in a formal report. The aircraft and store IPTs must have responsibility for and must agree on the final employment envelope released to the fleet. When applicable, the recommendation will specify which OFP release is necessary and is contingent upon verification acceptance of that software.

A brief synopsis of the tests is contained in Appendix (D). For specific series 200 test requirements refer to the appropriate test requirements section contained in MIL-STD-1763A.

INPUTS • Flight clearances for individual tests and build up flights

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- Test plans approved by the T&E facility test ranges
- Assets, both aircraft and stores
- Ground test results
- Aircraft OFP software
- Mission support software

OUTPUTS
- Flight test reports
- Weapons Delivery Accuracy (WDA) and Minimum Release Interval (MRI) data for incorporation into OFP
- Recommendation for fleet flight clearance
- Recommendation for SSSA V&V flight clearance
- Formal and message reports
- TACMAN tables

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10. Total System Verification Tests

These tests verify that the final "all-up" system configuration of aircraft, weapon system and associated support systems and equipment(e.g., mission planning, test and handling equipment, etc.) performs as intended. This testing, typically performed in later stages of the DT phase and sometimes in conjunction with operational testing, should be structured to provide assurance that all aspects of the total system work together as intended, and that for an existing operational system, there is no unanticipated system degradation. These tests involve releasing weapons against targets to verify the operation of the total weapon system. The tests are particularly important with stores that require in-flight guidance and control inputs but are also needed for ballistically targeted bombs. These particular tests are sometimes combined with software V&V, stores compatibility, weapon performance tests or system OPEVALs. Full systems tests are generally very expensive as they involve fully functioning weapons and can involve major targets, (ships, planes, tanks, etc.). This effort needs to be identified in the TEMP to ensure that the assets are available for the tests.

Upon successful completion of the software V&V and full system tests the Avionics Systems Project Officer or engineer will recommend to the PMA that the OFP be released for OPEVAL testing.

INPUTS
- Fully functional OFP
- Flight clearance

OUTPUTS
- Final OFP clearance recommendation

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11. Operational Test Readiness Review

The weapons system developer, technical support staff, and OPTEVFOR review and make a determination of readiness of the developed system for operational test and evaluation. It is responsibility of the system developer (PM) to formally certify that the system is ready for operational test and evaluation. With final airworthiness and OFP recommendation in hand, the primary issues are capability of the new system to meet its intended operational requirement, test facilities availability, test support personnel, training, support equipment, and logistical support for the tests. The system developer must show that all of these are in place prior to proceeding into Operational Evaluation testing (OPEVAL).

INPUTS	• Data/reports • Final OFP clearance recommendations • Stores compatibility flight clearance recommendation
OUTPUTS	• OPEVAL Flight clearance • Certification of readiness for OPEVAL

12. Integration Process Conclusion

The successful integration of a store onto an aircraft does not end with the completion of OPEVAL. While delivery of a fully functional weapons system to the fleet is the major objective of the integration process, the store and aircraft are now a single system for as long as both systems are in service. Store and aircraft modification and fleet identified problems with the system may require additional integration support. The Stores Integration IPT will remain a active part of the Aircraft IPT, at a reduced level of effort to ensure any system changes or problems are effectively managed or corrected, respectively.

Appendix (A)

DEFINITIONS

AIRCRAFT: A fixed wing, rotary wing, tilt rotor craft or vertical/short takeoff and landing vehicle, including onboard hardware and software, equipped with or without stores.

AIRCRAFT/STORES INTEGRATION: A process that begins with operational requirements definition of a new aircraft/store combination and ends with a fully operational and supportable weapon system capability. The process includes complete systems engineering, design and test of all electrical, mechanical, and avionics interfaces, and compatibility disciplines, as well as fielding of support equipment and defined mission planning system training requirements.

AIRCRAFT/STORES COMPATIBILITY: The ability of an aircraft, store, stores management system, and related suspension equipment to coexist without unacceptable effect of one on the aerodynamic, structural, or functional characteristics of the others under all flight and ground conditions expected to be experienced by the aircraft/store combination. A particular store may be compatible with an aircraft in a specific configuration, although not necessarily so with all pylons (or stations) or under all conditions.

CERTIFICATION: The determination of the extent of a specific store/aircraft compatibility and the formal publication of all information necessary for appropriate employment of a store on a specified aircraft (aircraft series) in the applicable technical manuals and flight operations manuals or interim supplements or revisions thereto.

FLIGHT CLEARANCE: Temporary approval for flight of an aviation system in a nonstandard configuration or operation outside the envelopes defined in NATOPS and TACMAN’s. The flight clearance is evidence that an independent engineering assessment of airworthiness has been performed, and the assessment indicates that the aviation system can be operated with an acceptable level of risk.

OPERATIONAL FLIGHT PROGRAM: The configuration item that refers to the collection of all individual software products necessary for the operation of a specific type or mnodel of aircraft.

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STORES: Any device carried internally or externally and mounted on suspension and release equipment (or air vehicle structure), whether or not the device is capable of being separated in flight from the aviation system Examples of aviation system stores are as follows: an Unmanned Aerial Vehicle (UAV) carried/launched from the manned air vehicle, missile, rocket, bomb, mine, torpedo, pyrotechnic device, sonobouy, fuel tank, pod (gun, refueling, electronic-countermeasures, etc.), tow target reel or similar item.

Appendix (B)

ACRONYMS

ACAT- Acquisition Catagory
APB- Acquisition Program Baseline
CNO- Chief of Naval Operations
COEA- Cost and Operational Effectiveness Analysis
CDR- Critical Design Review
DEM/VAL- Demonstration/Validation
DOD- Department of Defense
E^3- Electromagnetic Environmental Effects
EMC- Electromagnetic Compatibility
FOT&E- Follow on Operational Test and Evaluation
FRD- Functional Requirements Document
GSE- Ground Support Equipment
HERO- Hazards of Electromagnetic Radiation to Ordnance
ICD- Interface Control Document
ICWG- Interface Control Working Group
IPT- Integrated Program/Product Team
JROC- Joint Requirements Oversight Commitee
LSA- Logistics Support Analysis
MNS- Mission Needs Statement
MOE- Measures Of Effectiveness
NATOPS- Naval Air Training and Operating Procedures Standardization
OAG- Operational Advisory Group
OFP- Operational Flight Program
OPEVAL- Operational Evaluation
OPTEVFOR- Operational Test and Evaluation Force
ORD- Operational Requirements Document
PDR- Preliminary Design Review
PEO- Program Executive Officer
PMA- Program Management, Air
PM- Program Manager
RO- Requirements Officer
SCRB- Systems Change Review Board
SDR- System Design Review
SCR- System Concept Review
SE- Systems Engineering
SOW- Statement of Work
SPWM- Stores Planning and Weaponeering Module
SSSA- System Software Support Activity
TACMAN- Tactical Manual
TAMPS- Tactical Aircraft Mission Planning System
TEAM- Naval Air Systems Team
T&E- Test and Evaluation
TECHEVAL- Technical Evaluation
TEMP- Test and Evaluation Master Plan

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V&V- Validation and Verification
WIP- Weapons Integration Plan
WSSA- Weapon System Support Activity

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Appendix C

GROUND TESTING

1. Structural

The structural integrity of the store, suspension equipment, and the aircraft is evaluated through a series of on aircraft, lab/test fixture, and wind tunnel tests. Specifically, MIL-STD-1763A tests 110A, 120, 131A, 132, 141, 142, and 143. Refer to MIL-STD-1763A directly for test requirements and reporting criteria.

2. Wind Tunnel

This category of structural testing includes MIL-STD-1763A tests; Test 141 Effect of Aircraft on Captive Stores/Suspension Equipment, Test 142 Effect of Captive Stores/Suspension Equipment on Aircraft, Test 143 Aeroelastic Effects Test. Many of the aerodynamic and aeroelastic questions relative to aircraft/stores compatibility can be investigated in the wind tunnel to reduce the risk and complexities of flight test. However, test data for scaled models are not sufficient for certification purposes without proper interpretation and some flight test verification.

3. Environmental

Ground tests designed to satisfy the environmental concerns of vibration, Aero-acoustic effects, Hazards of Electromagnetic radiation to Ordnance (HERO), Electromagnetic Compatibility (EMC), and temperature extremes/thermal conditions are conducted to establish the store in question's ability to withstand and operate in the host aircraft's environment including the Carrier deck as well as in flight. Results from weapon/munitions developmental tests should be available to establish the basic store's susceptibility to these environmental conditions and will help tailor the installed tests.

4. Support of Stores Separation Certification

This section depicts those tests which need to be addressed prior to initiating a stores separation test program. These include lab/test fixture, wind tunnel, and gun/rocket/missile firing tests. The specific tests are covered in MIL-STD-1763A Tests 110A, 144, 161, and 162. Data for Test 110A and 144 are typically gathered during the testing required to support captive carriage, but not always. In addition, captive carriage data may supplement/augment data obtained early in the program and re-analysis run to fine tune the fidelity of separation models.

Appendix (D)

FLIGHT TESTING

1. Structural

MIL-STD-1763A series 200 flight tests are used to evaluate the structural integrity of the aircraft/store combination to establish the flight envelope for initial captive carriage flight and for the complete envelope at the end of testing. These tests are the initial series of flight tests but other phases of flight test may be initiated after an initial safe flight envelope is established. Thereafter, these flight tests will continue in parallel with other tests but always leading in establishing new edges of the flight envelope. The specific flight test series to be performed in this category include: Test 200 Inflight Loads Test, Test 210A Flutter Test, Test 252 Structural Integrity Test, Test 253 Vibration and Endurance Test.

2. Environmental

The purpose of the environmental flight tests is to determine if the aircraft/store and suspension equipment can withstand the actual flight environment to validate the design specification levels and to substantiate the predicted test levels. Environmental flight test of the store and suspension equipment are always performed in the captive carriage mode. This test is accomplished throughout the entire flight envelope to demonstrate that the store and its components will safely and satisfactorily operate. Instrumented aircraft and/or stores are generally used for these tests. The specific tests to be accomplished under the environmental category of airworthiness certification include: Test 221A Vibration Test, Test 222A Aero-acoustic Test, and Test 223 Thermal Test.

3. Support of Flying Qualities & Performance Certification

This series of tests are designed to evaluate the aircraft/store configuration during take-off, landing, and throughout the specified operational envelope defined by the aircraft/store mission. These tests ensure that the stores presence in different loadings does not adversely effect the pilots ability to control the aircraft or degrade the aircraft performance significantly. This series of tests include: Test 230 Flying Qualities Test, Test 240 Performance and Drag Tests, Test 250A Captive Compatibility Flight Profile (CFP) Tests (NOTE: This is a qualitative test usually conducted only if Test 230 is omitted by engineering judgement during the engineering analysis phase of stores certification), Test 251 Handling Qualities Test.

4. Support of Carrier Suitability Certification

Carrier suitability certification is achieved by satisfactorily accomplishing MIL-STD-1763A Test 260. This certification effort is essential for completion of the airworthiness certification of carrier based naval aircraft.

5. Separation / Employment Certification

During these tests, part or all of the stores are released from the aircraft. Even though wind tunnel tests are widely used to predict employment characteristics, flight testing is normally considered mandatory to demonstrate as a minimum, envelope extremes. Many occasions will arise when

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employment analogies or simulations are not available or sufficient and flight testing is the only available tool to determine safe employment envelopes.
Tests include; Test 271 Release Test, Test 272 Launch Test, Test 273 Gun Firing Test, Test 274 Dispense, Test 280 Jettison Test

6. Support of Ballistic Determination

These tests seek to define the freestream ballistics of a new store and the separation effects imposed on the store by the aircraft near field flow field. The ballistic equations derived from these tests are forwarded to the cognizant platform software agency for incorporation into the aircraft operational flight programs. Tests 291 Weapon Freestream Ballistics Test comprises the only element necessary to address this category of stores certification.

7. Support of OFP Development / Verification

Due to the extent of the testing required to adequately verify aircraft/weapon ballistic accuracy, the using command should clearly identify to the certificating agency the specific aircraft/weapon configurations requiring verification and OFP optimization in addition to clearly defining the accuracy acceptance criteria. The ballistic accuracy verification process consists of three phases: Test 292 OFP Ballistic Evaluation Test, Test 293 Separation effects derivation Test, Test 294 OFP Ballistic Verification Test.